



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/086,652	02/28/2002	William R. Ashurst	02307V-121600US	6884
20350	7590	11/14/2003	EXAMINER	
TOWNSEND AND TOWNSEND AND CREW, LLP TWO EMBARCADERO CENTER EIGHTH FLOOR SAN FRANCISCO, CA 94111-3834			MARKHAM, WESLEY D	
			ART UNIT	PAPER NUMBER
			1762	

DATE MAILED: 11/14/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b>		<b>Applicant(s)</b>	
	10/086,652		ASHURST ET AL.	
	<b>Examiner</b>		<b>Art Unit</b>	
	Wesley D Markham		1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

#### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All   b) ☐ Some \*   c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). ____.  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>20020605</u> . | 6) <input type="checkbox"/> Other: _____                                    |

**DETAILED ACTION**

1. Claims 1 – 18 are currently pending in U.S. Application Serial No. 10/086,652, and an Office Action on the merits follows.

***Information Disclosure Statement***

2. Acknowledgement is made of the IDS filed by the applicant on 6/5/2002. The references listed thereon have been considered by the examiner as indicated on the attached copy of the PTO/SB/08B form.

***Oath/Declaration***

3. Please note that the declaration provided by the applicant does not contain the P.O. address or the residence of each of the four inventors of the instant application. However, such information is provided on the Application Data Sheet submitted by the applicant.

***Specification***

4. The incorporation of essential material in the specification by reference to a foreign application or patent, or to a publication is improper (see page 3, lines 11 – 12, of the specification of the instant application, in which the applicant incorporates by reference the disclosures of several non-patent publications). If such material is “essential material”, applicant is required to amend the disclosure to include the material incorporated by reference. The amendment must be accompanied by an

affidavit or declaration executed by the applicant, or a practitioner representing the applicant, stating that the amendatory material consists of the same material incorporated by reference in the referencing application. See *In re Hawkins*, 486 F.2d 569, 179 USPQ 157 (CCPA 1973); *In re Hawkins*, 486 F.2d 579, 179 USPQ 163 (CCPA 1973); and *In re Hawkins*, 486 F.2d 577, 179 USPQ 167 (CCPA 1973).

5. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Specifically, the specification does not provide proper antecedent basis for the limitations in Claims 9 and 10 that (1) the gaseous mixture consists of a dichlorodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane, water vapor, and an inert gas (Claim 9), and (2) the gaseous mixture consists of dichlorodimethylsilane, water vapor, and molecular nitrogen (Claim 10). Appropriate correction is required.

#### ***Claim Rejections - 35 USC § 112***

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 9 and 10 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
8. Specifically, Claim 9 recites the limitation "said dichlorodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane in line 2 of the claim, and Claim 10 recites the limitation "said dichlorodimethylsilane" in line 2

of the claim. There is insufficient antecedent basis for these limitations in the claims. Particularly, Claims 9 and 10 depend from Claim 1, and Claim 1 only recites a dihalodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane, not a dichlorodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane or dichlorodimethylsilane. Therefore, it is unclear whether Claims 9 and 10 specifically require a dichlorodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane and dichlorodimethylsilane, respectively, or generally require a dihalodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane, as recited in independent Claim 1. As such, the scope of the claims is unclear, and the claims are indefinite under 35 U.S.C. 112, second paragraph.

### ***Claim Rejections - 35 USC § 102***

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

10. Claims 1 – 6, 8, 15, and 16 are rejected under 35 U.S.C. 102(e) as being anticipated by Leung et al. (USPN 6,576,489 B2).
11. Regarding independent **Claim 1** (from which Claims 2 – 18 depend), Leung et al. teaches a method for applying a silane coating to a surface that is at least partially

wettable by water, the method comprising exposing the surface to a vapor-phase dihalodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane under conditions resulting in the formation of a monolayer coating on the surface (Abstract, Figure 4, Col.1, lines 34 – 40, Col.2, lines 24 – 26 and 38 – 59, Col.3, lines 1 – 5 and 46 – 67, Col.4, lines 46 – 67, Col.5, lines 32 – 37 and 66 – 67, and Col.6, lines 1 – 52). Leung et al. does not explicitly teach that the conditions result in the bonding of di(C<sub>1</sub>-C<sub>3</sub> alkyl)silyloxy groups to the surface. However, the “conditions” of the process of Leung et al., including (1) the specific vapor-phase silane compound utilized, (2) the specific substrate / surface material treated, and (3) the process temperature are the same as the applicant’s claimed and disclosed process “conditions”. Therefore, unless essential process steps and/or limitations are missing from the applicant’s claims, the process of Leung et al. would have inherently resulted in the bonding of di(C<sub>1</sub>-C<sub>3</sub> alkyl)silyloxy groups to the surface because the process conditions of Leung et al. are the same as the applicant’s process conditions. Regarding **Claims 2 and 3**, Leung et al. also teaches that the dihalodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane is a dichlorodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane (Claim 2), specifically dichlorodimethylsilane (i.e., DCDMS) (Claim 3) (Col.6, line 5). Regarding **Claims 5 – 6**, Leung et al. also teaches that the surface is a polycrystalline silicon (i.e., polysilicon) semiconductive surface that has been oxidized by exposing the surface to OH (i.e., hydroxyl) radicals (i.e., that the surface is hydroxyl-terminated (poly)silicon) (Col.1, lines 34 – 40, Col.2, lines 49 – 55, Col.4, lines 46 – 64, and Col.6, lines 5 – 11). This oxidized / hydroxyl-terminated polysilicon surface is considered to be “hydrophilic”, as required by applicant’s **Claim 4** (see, for example,

page 5, lines 20 – 25, of the applicant's specification). Regarding **Claim 8**, Leung et al. also teaches that the exposure is performed in a non-oxidizing atmosphere (Col.5, lines 32 – 49). Regarding **Claims 15 and 16**, Leung et al. also teaches that the exposure is performed at a temperature of from about 0°C to about 85°C (Claim 15), specifically at a temperature of from about 15°C to about 50°C (Claim 16) (Col.6, lines 19 – 21).

12. Claims 1 – 5 and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by Patnode (USPN 2,306,222).

13. Regarding independent **Claim 1**, Patnode teaches a method for applying a silane coating to a surface that is at least partially wettable by water, the method comprising exposing the surface to a vapor-phase dihalodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane, under conditions resulting in the deposition of a water-repellent coating on the surface (Col.1, lines 1 – 8 and 33 – 45, Col.2, lines 1 – 12 and 32 – 35, Col.3, lines 40 – 60, and Col.4, lines 1 – 15). Patnode does not explicitly teach that the conditions result in the bonding of di(C<sub>1</sub>-C<sub>3</sub> alkyl)silyloxy groups to the surface. However, the relevant "conditions" of the process of Patnode, including (1) the specific vapor-phase silane compound utilized (Col.2, line 4), and (2) the specific substrate / surface material treated (Col.2, lines 2 and 32) are the same as the applicant's claimed and disclosed process "conditions". Therefore, unless essential process steps and/or limitations are missing from the applicant's claims, the process of Patnode would have inherently resulted in the bonding of di(C<sub>1</sub>-C<sub>3</sub> alkyl)silyloxy groups to the surface.

Regarding **Claims 2 and 3**, Patnode also teaches that the dihalodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane is a dichlorodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane (Claim 2), specifically dichlorodimethylsilane (i.e., DCDMS) (Claim 3) (Col.2, line 4). Regarding **Claims 4 and 5**, Patnode also teaches that the surface is hydrophilic (Claim 4) (Col.1, lines 33 – 38) and that the surface is a member selected from the group consisting of glass, alumina, etc. (Claim 5) (Col.2, lines 2 and 32). Regarding **Claim 8**, Patnode also teaches that the exposure atmosphere is a mixture of methyl silicon chlorides (i.e., that the exposure is performed in a “non-oxidizing” atmosphere) (Col.2, lines 2 – 7).

14. Claims 1 – 5, 7, 15, and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Frey et al. (USPN 4,274,856).
15. Regarding independent **Claim 1**, Frey et al. teaches a method for applying a silane coating to a surface that is at least partially wettable by water, the method comprising exposing the surface to a vapor-phase dihalodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane under conditions resulting in the formation of a release coating on the surface (Abstract, Col.1, lines 6 – 8, 25 – 29, and 41 – 51, Col.2, lines 1 – 15, and Example 1). Frey et al. does not explicitly teach that the conditions result in the bonding of di(C<sub>1</sub>-C<sub>3</sub> alkyl)silyloxy groups to the surface. However, the “conditions” of the process of Frey et al., including (1) the specific vapor-phase silane compound utilized, (2) the specific substrate / surface material treated (i.e., glass), (3) the process temperature, and (4) the exposure of the surface to water vapor are the same as the applicant’s claimed and disclosed process “conditions”. Therefore, unless essential process



steps and/or limitations are missing from the applicant's claims, the process of Frey et al. would have inherently resulted in the bonding of di(C<sub>1</sub>-C<sub>3</sub> alkyl)silyloxy groups to the surface because the process conditions of Frey et al. are the same as the applicant's process conditions. Regarding **Claims 2 and 3**, Frey et al. also teaches that the dihalodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane is a dichlorodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane (Claim 2), specifically dichlorodimethylsilane (i.e., DCDMS) (Claim 3) (Col.1, line 26, Col.2, lines 1 – 2, and Example 1). Regarding **Claims 4 and 5**, Frey et al. also teaches that the surface is glass (Claim 5) (Col.2, line 3, and Example 1), which has been reasonably construed by the examiner to be "a hydrophilic surface", as required by Claim 4. Regarding **Claim 7**, Frey et al. also teaches exposing the surface to water vapor while exposing the surface to the vapor-phase dihalodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane (Col.1, lines 26 – 28, Col.2, lines 3 – 15, and Example 1). Regarding **Claims 15 and 16**, Frey et al. also teaches that the exposure is performed at "ambient temperature" (i.e., ~25°C), which falls within the temperature range(s) required by Claims 15 and 16 (Col.2, lines 6 – 7, and Example 1).

### ***Claim Rejections - 35 USC § 103***

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

17. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).
18. Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leung et al. (USPN 6,576,489 B2).
19. Leung et al. teaches all the limitations of Claims 13 and 14 as set forth above in paragraph 11, except for a method wherein the exposure is performed at a total pressure of from about 0.1 to about 15 torr (Claim 13), particularly from about 1 torr to about 5 torr (Claim 14). However, Leung et al. does teach that the pressure in the reaction chamber (i.e., the total pressure) should be below atmospheric pressure (i.e., below 760 torr) but sufficiently high to have a suitable amount of alkylsilane-containing molecules present for expeditious formation of the coating (Col.6, lines 21 – 25). In other words, Leung et al. teaches that the pressure is a result / effective variable that should be kept below atmospheric pressure and determines the speed at which the coating is formed (i.e., a higher pressure leads to a more expeditious (i.e., faster) formation of the coating). Therefore, it would have been obvious to one

of ordinary skill in the art to optimize the total pressure in the process of Leung et al. as a result / effective variable through routine experimentation in order to achieve a desirably high deposition rate while maintaining the pressure below atmospheric pressure (i.e., below 760 torr), as taught by Leung et al.

20. Claims 7, 9, 10, 17, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leung et al. (USPN 6,576,489 B2) in view of Mayer et al. ("Chemical vapor deposition of fluoroalkylsilane monolayer films for adhesion control in microelectromechanical systems", Sept/Oct 2000).
21. Leung et al. teaches all the limitations of Claims 7, 9, and 10 as set forth above in paragraph 11, except for a method further comprising exposing the surface to water vapor while exposing the surface to the silane compound (Claim 7), particularly exposing the surface to a gaseous mixture consisting of a dichlorodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane, water vapor, and an inert gas (Claim 9), more particularly exposing the surface to a gaseous mixture consisting of DCDMS, water vapor, and molecular nitrogen (Claim 10). Specifically, Leung et al. teaches exposing the surface to a gaseous mixture consisting of DCDMS and molecular nitrogen (N<sub>2</sub>) as an inert gas, but teaches that such exposure is performed in the absence of water (Col.5, lines 32 – 49 and 66 – 67, and Col.6, lines 1 – 31). In other words, the only difference between applicant's Claims 7, 9, and 10 and the process of Leung et al. is the inclusion of water vapor in the gaseous mixture. Mayer et al. teaches a similar process of vapor-depositing a monolayer, hydrophobic coating on the surface of a

MEMS device (Abstract). Additionally, Mayer et al. teaches that the deposition process can be improved by adding water vapor to the gaseous chlorosilane precursor mixture (i.e., because the chlorosilanes do not rapidly react with surface hydroxyl groups to form a coating in the absence of the water vapor) (page 2436, section B., paragraph 2). Therefore, it would have been obvious to one of ordinary skill in the art to add water vapor to the gaseous mixture of Leung et al. with the reasonable expectation of successfully and advantageously improving the deposition process (i.e., forming a stable film), as taught by Mayer et al. Leung et al. teaches all the limitations of Claims 17 and 18 as set forth above in paragraph 11, except for a method wherein the exposure is performed for a continuous exposure time of from about 3 minutes to about 30 minutes (Claim 17), particularly from about 10 minutes to about 20 minutes (Claim 18). However, Leung et al. does teach that parameters such as the treatment time are preferably adjusted to form a uniform monolayer across the surfaces of the substrate (Col.6, lines 25 – 28). Mayer et al. teaches a similar process of vapor-depositing a monolayer, hydrophobic coating on the surface of a MEMS device (Abstract). Further, Mayer et al. teaches that an exposure time of 15 minutes is sufficient to deposit a monolayer coating and that the growth rate slows dramatically after 15 minutes (page 2436, section B., paragraph 2). Therefore, it would have been obvious to one of ordinary skill in the art to perform the exposure / deposition process of Leung et al. continuously for a period of time of, for example, 15 minutes (as taught by Mayer et al.) in order to successfully deposit a monolayer film, as desired by Leung et al. In other words, one of ordinary skill in the art would

have utilized a treatment time of 15 minutes because such a time is taught to be sufficient for forming a monolayer film, which is desired by Leung et al.

22. Claims 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Leung et al. (USPN 6,576,489 B2) in view of Breen et al. (US 2002/0172895 A1).

23. Leung et al. teaches all the limitations of Claims 11 and 12 as set forth above in paragraph 11, except for a method wherein the vapor-phase dihalodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane, specifically DCDMS, is at a partial pressure of from about 0.5 torr to about 5.0 torr (Claim 11), particularly about 1.0 to about 3.0 torr (Claim 12). Specifically, Leung et al. is silent as to the DCDMS partial pressure, but teaches that a suitable amount of alkylsilane-containing molecules should be present for expeditious formation of the coating and that parameters such as the flow rate of the alkylsilane reagent should be adjusted to form a uniform monolayer on the surfaces (Col.6, lines 19 – 28). Additionally, Leung et al. teaches that the alkylsilane-containing molecule source can be heated to increase the vapor pressure (i.e., partial pressure) of the alkylsilane-containing molecules (Col.6, lines 28 – 31). In other words, Leung et al. teaches that the partial pressure of the silane compound can be controlled and/or regulated. Breen et al. teaches a similar method of vapor depositing a silane coating on a substrate (Abstract) and teaches that the partial pressure of the silane compound in the deposition chamber can be controlled by various process parameters (paragraph [0019]). It would have been obvious to one of ordinary skill in the art to optimize the partial pressure of the silane compound of

Leung et al. with the reasonable expectation of (1) success, as both Leung et al. and Breen et al. teach that such partial pressure can be controlled / regulated, and (2) obtaining the benefits of optimizing the aforementioned partial pressure, such as providing a suitable amount of alkylsilane-containing molecules in the deposition chamber in order to expeditiously (i.e., quickly) form the coating.

24. Claims 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Frey et al. (USPN 4,274,856).

25. Frey et al. teaches all the limitations of Claims 17 and 18 as set forth above in paragraph 15, except for a method wherein the exposure is performed for a continuous exposure time of from about 3 minutes to about 30 minutes (Claim 17), particularly from about 10 minutes to about 20 minutes (Claim 18). However, Frey et al. does teach that the exposure time should be "several minutes" (Col.2, lines 10 – 11). As the term "several" is conventionally defined as more than two and less than many, it is the examiner's position that Frey et al.'s teaching of "several minutes" reasonably suggests performing the exposure for a period of time of, for example, about 10 minutes (i.e., a number that is more than two and less than many). The exact exposure time would have been determined by one of ordinary skill in the art based on other various conditions (i.e., the desired film thickness, the rate at which the film is deposited, etc.).

26. Claims 1 – 5, 7, 8, and 13 – 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al. (USPN 6,190,003 B1).
27. Regarding independent **Claim 1**, Sato et al. teaches a method of applying a silane coating to a surface that is at least partially wettable by water, the method comprising exposing the surface to a vapor-phase silane such as hexamethyldisilazane (HMDS) under conditions resulting in the deposition of a hydrophobic film (Abstract, Figure 6, Col.2, lines 44 – 63, Col.6, lines 9 – 26, Col.7, lines 30 – 52, and Col.9, lines 34 – 50). In the vapor-phase exposure embodiment, Sato et al. does not explicitly teach that the silane is a dihalodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane. However, Sato et al. does teach that HMDS is only one member of a class of materials that can be utilized in accordance with the present invention, that the class of materials also includes DCDMS (i.e., a dihalodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane), and that experiments have shown that the discussion regarding the HMDS species applies to the other members of the class in substantially the same way (Col.12, lines 27 – 46). Therefore, it would have been obvious to one of ordinary skill in the art to utilize DCDMS in the process of Sato et al. instead of HMDS with the reasonable expectation of success and obtaining similar results (i.e., successfully depositing a hydrophobic silane film, as desired by Sato et al., regardless of whether HMDS or DCDMS is utilized as the precursor). Additionally, Sato et al. does not explicitly teach that the conditions result in the bonding of di(C<sub>1</sub>-C<sub>3</sub> alkyl)silyloxy groups to the surface. However, the “conditions” of the process of Sato et al., including (1) the specific vapor-phase silane compound utilized, (2) the specific substrate / surface

material treated, (3) the process temperature, (4) the process pressure, and (5) the exposure time are the same as the applicant's claimed and disclosed process "conditions". Therefore, unless essential process steps and/or limitations are missing from the applicant's claims, the process of Sato et al. would have inherently resulted in the bonding of di(C<sub>1</sub>-C<sub>3</sub> alkyl)silyloxy groups to the surface because the process conditions of Sato et al. are the same as the applicant's process conditions.

Regarding **Claims 2 and 3**, Sato et al. also teaches that the dihalodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane is a dichlorodi(C<sub>1</sub>-C<sub>3</sub> alkyl)silane (Claim 2), specifically dichlorodimethylsilane (i.e., DCDMS) (Claim 3) (Col.12, lines 27 – 46). Regarding **Claims 4 and 5**, Sato et al. also teaches that the surface is a hydroxyl-terminated silicon surface, which has been reasonably construed by the examiner to be a "hydrophilic surface" (Figure 6 and Col.7, lines 48 – 52). Regarding **Claim 7**, Sato et al. teaches exposing the surface to water vapor while exposing the surface to the vapor-phase silane compound (Col.4, lines 14 – 19 and Col.7, lines 30 – 37).

Regarding **Claim 8**, Sato et al. does not make any mention or suggestion that the water vapor present in the exposure atmosphere oxidizes either the coating or the substrate, and therefore the environment of Sato et al. has been reasonably construed by the examiner to be "non-oxidizing", as required by Claim 8. Regarding **Claims 13 and 14**, Sato et al. teaches that the exposure is performed at a vacuum of 10 torr or greater (i.e., at a total pressure of 10 torr or less) (Col.9, lines 48 – 49). This pressure falls within / overlaps the applicant's claimed pressure range(s).

Regarding **Claims 15 and 16**, Sato et al. teaches an exposure temperature of, for



example, 20°C (Col.9, line 48), which falls within the applicant's claimed temperature range. Regarding **Claims 17 and 18**, Sato et al. teaches a continuous exposure time of between approximately 5 and 150 minutes (Col.9, lines 48 – 49). This exposure time falls within / overlaps the applicant's claimed range of time periods. Please note that overlapping ranges are *prima facie* obvious.

28. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al.

(USPN 6,190,003 B1) in view of Leung et al. (USPN 6,576,489 B2).

29. Sato et al. teaches all the limitations of Claim 6 as set forth above in paragraph 27, except for a method wherein the surface is hydroxyl-terminated polysilicon.

However, Sato et al. does teach that the surface is hydroxyl-terminated silicon in general (Figure 6 and Col.7, lines 49 – 52). Leung et al. teaches that silane coatings such as those deposited on the surface of Sato et al. can be deposited on either polycrystalline silicon (i.e., polysilicon) or amorphous silicon structures (Abstract and Col.1, lines 34 – 40). Therefore, it would have been obvious to one of ordinary skill in the art to perform the process of Sato et al. specifically on a hydroxyl-terminated polysilicon surface (i.e., as opposed to a hydroxyl-terminated silicon surface in general) with the reasonable expectation of success and obtaining similar results, regardless of whether the silicon surface of Sato et al. is polycrystalline or amorphous.

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Hunter (USPN 4,644,907) teaches that DCDMS is an inexpensive coating material that can be vapor deposited onto a substrate. Ioka et al. (USPN 6,479,374 B1) teaches that exposure to a silylation agent such as DCDMS vapor is used to treat a silicon oxide film in order to suppress the water absorption of the film. Alley et al. (USPN 5,403,665) teaches that alkyltrichlorosilane SAMs are utilized to lubricate the surface of a micromachine. Henck et al. (EP 0 845 301 A1) teaches a method for forming protective coatings on micromechanical devices comprising exposing the surface of the devices to a chlorosilane material which reacts with the water / hydroxyl species on the surface in order to form a strong monolayer. Wang (USPN 6,265,026 B1) teaches a method for vapor depositing a monolayer coating on a silicon surface by using alkyltrichlorosilane compounds.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wesley D Markham whose telephone number is (703) 308-7557. The examiner can normally be reached on Monday - Friday, 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (703) 308-2333. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Application/Control Number: 10/086,652  
Art Unit: 1762

Page 18

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.



WDM

Wesley D Markham  
Examiner  
Art Unit 1762



SHRIVE P. BECK  
SUPERVISORY PATENT EXAMINER  
1700 CENTER 1700